Abstract No. feng503

**Geometrical and Transport Properties of Rocks from CMT Images**

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Beamline(s): X27A

The microgeometry of sandstones is of particular interest since sandstone structures are of importance in understanding the behavior of petroleum reservoirs and for providing a rational basis for development of improved petroleum recovery methods. The thrust of the present experiment includes measuring the structures of sandstones using computed microtomography and extracting information that can be used for flow calculations. Measurements of a variety of sandstones are needed in this regard in order to establish the range of variations in the materials that may occur in different oil fields.

The CMT apparatus at the BNL NSLS X27A beam line was used to make the measurements [1]. The voxel size employed was 0.0067 mm. The tomographic volume data was segmented into rock and pore space prior to analysis (Fig. 1). The porosities found for the red Vosges sandstone and other samples were in good agreement with values found using standard methods. The two-point correlation functions determined from the analysis are shown in Fig. 2. They are well described by a negative exponential function with a decay length of 0.0296 mm. An important transport property to be determined is whether the pore space percolates or not, i.e., whether a continuous path through the pore space exists between two opposite faces of the sample. In the absence of percolation, all the macroscopic coefficients for transport processes in the pore space are trivially zero. A calculation of the electrical conductivity of the sample relative to a sample filled with a conducting liquid was made with the assumption that the solid phase is an insulator. The calculations were made for blocks of voxels ranging in size from $32^3$ to $170^3$. The results of the calculations for porosity and conductivity are shown in Fig. 3. The calculations showed that the probability of percolation depended on the block size. In the future, this type of analysis will be extended to measurements made on other sandstones and used to establish a grain-size basis for larger-scale fluid flow predictions.

**Acknowledgments**: Work supported in part by the US Department of Energy under Contract No. DE-AC0-98CH10886

**References**: 1. B. A. Dowd, A. B. Andrews, R. B. Marr, D. P. Siddons, K. W. Jones, and A. M. Peskin. Advances in X-Ray Computed Microtomography at the NSLS. Presented at 47th Annual Denver X-Ray Conference, Colorado Springs, Colorado, August 3-7, 1998. Advances in X-Ray Analysis **42**, Plenum Publishing Corp., New York.

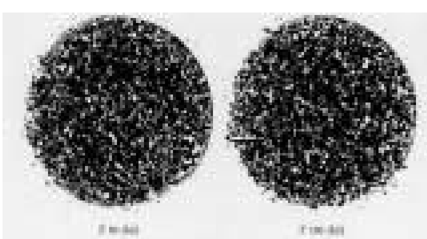

**Figure 1 (Left).** Typical sections through a sample of red Vosges sandstone measured at the BNL X27A beam line. The data have been segmented into pore space (white) and solids (black).

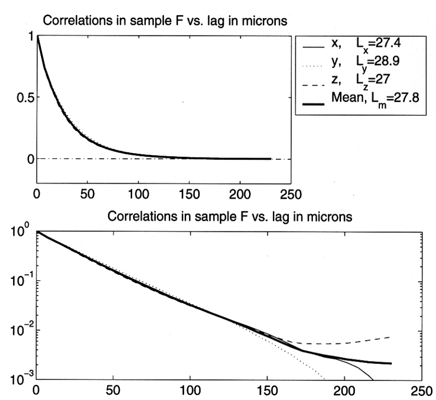


**Figure 2 (Center).** Two-dimensional correlation functions for red Vosges sandstone are shown. They were calculated from the type of data shown in Fig. 1.

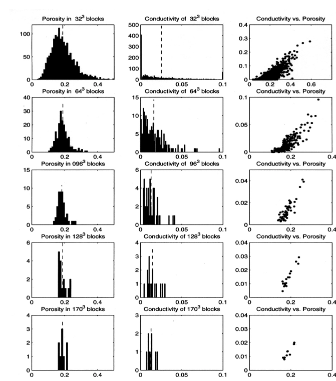


**Figure 3 (Right).** Results of calculations of porosity, conductivity, and porosity vs. conductivity for the red Vosges sandstone sample are shown for different size data blocks extracted from the complete volume.